AT&T Wireless
Cingular Wireless
QUALCOMM
January 22, 2002

VIA ELECTRONIC FILING

Ms. Magalie R. Salas
Federal Communications Commission
236 Massachusetts Avenue, N.W.
Washington, D.C. 20002

Re: Written Ex Parte Presentation
ET Docket No. 98-153

Dear Ms. Salas:

On behalf of AT&T Wireless, Cingular Wireless, and QUALCOMM (collectively, the "Wireless Companies"), this letter responds to a January 3, 2002 written ex parte filing by XtremeSpectrum in the above-referenced proceeding.[1]

I. Summary

The Wireless Companies made several filings in December 2001 in which they urged the Commission not to allow ultra wideband communications devices to operate below 6 GHz because tests of UWB devices have demonstrated that they will cause significant harmful interference to existing wireless services, including safety of life services, if operated in such bands.[2] XtremeSpectrum does not deny that UWB devices, if unabated, will cause such harmful interference. In fact, several months ago, XtremeSpectrum proposed an emissions mask for UWB as low as 35 dB below Part 15 Class B levels, although protection of that magnitude was limited to the GPS bands.[3] Instead, XtremeSpectrum replies to the filings of the Wireless Companies by insisting, on the basis of no actual testing of its own, that its proposed emissions mask will be sufficient, and that the risk of harmful interference has been overstated, relying on the average power levels of UWB devices. XtremeSpectrum supports this argument by

[1]Sprint PCS also supports this filing, but is filing a separate response to the XtremeSpectrum Ex Parte to submit new test results which rebuts the erroneous claim that UWB devices are just like personal computers and other Part 15 devices in their emissions and impacts on wireless phones operating in the PCS bands.
[2]See QUALCOMM, Verizon Wireless, AT&T Wireless, and Cingular Wireless, Ex Parte (filed Dec. 5, 2001); Verizon Wireless, on behalf of AT&T Wireless, Cingular Wireless, QUALCOMM, Sprint PCS, and Verizon Wireless, Ex Parte (filed Dec. 4, 2001); Sprint Ex Partes (filed Nov. 16 and Dec. 4, 2001); and, Cingular Ex Parte (filed Nov. 13, 2001).

making a series of misstatements regarding the tests carried out by the Wireless Companies.

XtremeSpectrum's argument misses the fundamental problem which the Commission has to resolve before it can conclude that there will not be interference to wireless phones from UWB emissions: the tests in the record have proven that wireless phones suffer harmful interference as a result of transmissions from nearby UWB devices, and no private or public party, including XtremeSpectrum, the other UWB proponents, and the Commission itself, has conducted any test of an emissions mask or other restriction to prove that such protective measures will successfully mitigate the harmful interference.

The fact that overall average power levels across the entire swath of spectrum covered by a UWB transmission are low, in the opinion of the UWB proponents, will not provide solace to the user of a PCS phone who has his or her call blocked or dropped because of dense power received from a nearby UWB device. Laptops, microwave ovens, and other Part 15 devices do not intentionally emit such dense power into the PCS band as UWB devices have been shown to emit. UWB devices are not like current Part 15 devices.

To confirm, the tests in the record uniformly demonstrate that UWB devices will cause significant harmful interference to PCS systems, whether measured in terms of disruption of normal operation or degradation in reception quality. There are no tests in the record which support any contrary conclusion.

In this regard, most recently, on January 11, 2002, QUALCOMM submitted the results of a series of additional tests it recently conducted of the harmful interference from UWB emissions on QUALCOMM's E911 technology, known as gpsOne. These tests proved that wireless phones using QUALCOMM's E911 technology cannot meet the FCC's E911 mandate in the face of UWB emissions.[4] The FCC's E911 mandate was adopted to enhance the public's safety because there are already over 100,000 calls each day to 911 from wireless phones, and Public Safety Answering Points (PSAPs) do not automatically receive the location of such callers. QUALCOMM's tests showed that the presence of UWB emissions within the GPS spectrum significantly raises the noise floor of the GPS sensor to the extent that it will render the GPS device useless in reporting position location information to PSAPs.

Moreover, Assistant Secretary of Defense John Stenbit recently wrote that the Department of Defense has concluded its own technical studies of UWB emissions and believes that emissions below 4.2 GHz will cause harmful interference to DoD systems, including a number of highly sensitive systems.[5] The Commission has not conducted any

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[3] See XtremeSpectrum Ex Parte (filed September 10, 2001).
[4] See QUALCOMM Written Ex Parte (filed January 11, 2002).
[5] See Letter from Assistant Secretary of Defense John Stenbit to Deputy Assistant Secretary of Commerce Michael D. Gallagher, January 11, 2002 (the "January 11th Stenbit Letter").

tests of its own, and no test in the record supports the notion that UWB will not interfere with the services provided by the Wireless Companies. The burden is on the UWB proponents to conduct such tests.

The tests on which the Wireless Companies rely were reasonable and conclusively establish that UWB devices will cause harmful interference to PCS phones. XtremeSpectrum's arguments are erroneous.

Emissions Levels. XtremeSpectrum criticized the UWB emissions levels in the tests as being too high, but the record in this proceeding showed that even at very low power levels, UWB devices will cause harmful interference.

Numbers of UWB Devices. Similarly, XtremeSpectrum claims that the PCS tests assume extremely largenumbers of UWB devices per square kilometer, but at least four tests (QUALCOMM, NTIA, Stanford University, and Sprint PCS/Time Domain) used only one device and showed that the harmful interference is caused by one UWB device at distances that far exceed the normal office size. It is true though that the proliferation of UWB devices will aggravate the situation, as Intel, a proponent of UWB, admitted in a filing with the Commission.

Intrinsic Noise vs. Excess Noise from UWB Devices. XtremeSpectrum asks the Commission to disregard the harmful interference PCS phones will suffer from UWB devices because PCS phones already suffer noise from other PCS callers, but such intrinsic noise is an inherent feature of the multiple access PCS system and is already built into the system's design. On the other hand, excess noise from UWB devices will eat into the system's margin and disrupt the normal operation of the system.

Speculation About Indoor Operation. In a similar vein, XtremeSpectrum speculates that indoor walls, furniture, and within-the-room reflections will minimize interference, but no test of UWB devices supports this speculation. To the contrary, line-of-sight propagation within an office will follow free space. There are countless scenarios in which people could be, wittingly or unwittingly, using UWB devices indoors within the same office or room as PCS phones.

Aggregation. Finally, XtremeSpectrum states without any supporting testing that UWB emissions add, as do other radio-frequency signals, but do not aggregate at a victim receiver. Even Intel has admitted that interference power from UWB devices will add non-coherently, and that this aggregation is a problem. No study in the record establishes that an emissions mask or other regulatory restriction will ameliorate the aggregation of harmful interference.

"Trust Us" vs. the Demonstrated Likelihood of Harmful Interference. Finally, XtremeSpectrum effectively tells all the Wireless Companies to trust it. It won't make devices which interfere with PCS handsets, it says, because the market will ensure that its products are non-interfering, (XtremeSpectrum Ex Parte at Pg. 15). This argument jettisons the entire 67-year history of the FCC and the Communications Act

The FCC has never authorized a new service which has a demonstrated likelihood of causing harmful interference to licensed services, including safety of life services, on the basis of a bare promise from the developer not to make interfering products, and the FCC should never do so. Once the promise is breached, it will be, as a practical matter, impossible to retrieve countless number of interfering devices to cure the interference. The tests prove that UWB communications devices will cause harmful interference to radio receivers, and before these devices are authorized, this problem must be cured.

For these reasons, and consistent with the January 11th Stenbit Letter, the Wireless Companies continue to urge the Commission not to authorize UWB communications devices below 6 GHz. We say above 6 GHz because of the interference not only to PCS systems from UWB devices operating below 3.1 GHz, and DOD systems operating between 3.1 and 4.2 GHz (as reflected in Assistant Secretary of Defense Stenbit's letter), but also because UWB devices operating above 4.2 GHz and below 6 GHz would interfere with other critical aviation systems which are safety of life services. The January 11th Stenbit Letter (at page 3) expressly took account of the interference to these critical aviation systems, referring to other executive branch organizations who also wish to protect their systems from interference.

II. XtremeSpectrum Makes a Series of Misstatements About the Tests Of UWB Devices

XtremeSpectrum claims that the key PCS studies (the QUALCOMM study, the Telcordia model, and the Sprint PCS/Time Domain tests), while well designed and carried out, used erroneous assumptions. In fact, however, it is XtremeSpectrum which has made errors in this very set of arguments. Each error by XtremeSpectrum is set forth below.

XtremeSpectrum Myth 1: Emissions Limits Can Cure the Harmful Interference.

According to XtremeSpectrum: "Most of the PCS studies were based on UWB emissions levels much higher than any proposals before the Commission. The Commission's NPRM specified a 94% reduction below Class B in the PCS band. XtremeSpectrum has proposed that same level for non-peer-to-peer operations, and a more stringent 98% reduction for peer-to-peer operations. These levels offer substantial protection to PCS, compared to the Class B levels used in the studies." XtremeSpectrum Ex Parte at Pg. 5 (footnotes omitted).

Fact 1: UWB Will Cause Harmful Interference Even If Operated 30 dB Below Class B

No test establishes that the emissions levels proposed by XtremeSpectrum will cure the harmful interference from UWB devices, and this harmful interference will occur at power levels significantly below Part 15 levels. Continuous transmissions from a UWB device cannot be considered spurious emissions along the lines of those emitted by run-of-the-mill Part 15 devices.

In order to see the magnitude of the harmful interference from UWB devices, consider 2 UWB devices transmitting at a power level that is 30 dB (one thousandth) below Part 15 Class B devices. Assume that these devices are at equal distance from a communication device with 8 dB noise figure (very typical for communication devices). The amount of excess noise power spectral density introduced when these devices are at 1 meter separation distance is –166.3 dBm/Hz[6]. This is equivalent to doubling the noise figure of the receiver. Increasing the noise figure is equivalent to making these receivers less sensitive to marginally strong desired signals. Theoretically, it is impossible to restore the victim receiver equivalent noise figure to its original value, unless the UWB devices are disabled. The designer of the communications device needs to decrease the original noise figure to 3 dB to restore the resultant noise figure to one dB higher than the original value (i.e., accepting one dB degradation). Designing a communication device with a 3 dB noise figure is impractical, and sometimes physically impossible because consumers demand small, affordable, and lightweight devices.
Thus, the harmful interference will be substantial and very difficult and costly to ameliorate, if it can be ameliorated.

Indeed, although the testing by Sprint and QUALCOMM was conducted in the PCS bands, the harmful interference in the cellular bands will be even more severe. The interference to that band will be exacerbated because the Part 15 limit for bands below 960 MHz is 1.2 dB higher than for bands above 960 MHz (measured in 1 MHz) and the propagation loss is less at 800 MHz. (While the Part 15 field strength limits below 960 MHz is lower, the resolution bandwidth is also much lower, hence the overall power in 1 MHz is higher.

Two UWB devices in the vicinity of the communication device will be the norm if UWB is authorized for peer-to-peer communications in indoor environments. An example is a cubical office environment with UWB implemented in computers, laptops and palm-type organizers. People around meeting tables exchanging files are usually separated less than 3 meters. People in conference halls exchanging business cards are also separated less than 3 meters. As a matter of fact, we expect more UWB devices at closer distances from the communication device, especially if the UWB devices are used for personal gadgets such as in wireless headsets, CD and MP3 players. Workers in a cubical office environment are separated by less than 3 meters. Recognizing the harmful effects that would be caused by UWB devices if the proposed rules were promulgated, XtremeSpectrum[7] has proposed in correspondence with the FCC emission masks that are as low as 35 dB below Class B levels (although the 35 dB mask would be limited to the GPS bands). This proposal by itself is an admission that these devices if allowed to operate in the restricted bands will cause great harm to the normal operation of licensed devices. Since noise impacts all receivers the same way, any protection to GPS should apply to all licensed bands.

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[6] Excess noise PSD = -41.3 (Class B) – 30 (mask level) –38 (propagation loss) + 3 (two devices) – 60 (1 MHz). These calculations are done at 1900 MHz (the PCS band).
[7] XtremeSpectrum Ex Parte Communications filed September 10, 2001.

Another filing in the record shows that UWB devices will cause interference when operated at the power levels specified in the Notice of Proposed Rule Making. Intel, itself a UWB proponent, showed in its Reply Comments[8] that a UWB device operating with transmit power at the level specified in the NPRM for frequencies above 2 GHz at a distance of 2 meters from a Bluetooth receiver would degrade the noise figure of a Bluetooth receiver by about 21 dB. The Bluetooth receiver under investigation is assumed to have 6 dB noise figure. As mentioned in several reply comments in this docket, any victim receiver (such as a wireless phone) will behave the same as long as the UWB interference is represented as a additive white noise.

XtremeSpectrum Myth 2: The Studies Assume An Unduly High Number of UWB Devices.

According to XtremeSpectrum: "The PCS studies assume extremely large numbers of UWB devices, ranging up to 5,000 to 100,000 active emitters per square kilometer. Even for a population-dense region such as metropolitan New York City, this works out to *ten operating UWB transmitters for every man, woman, and child*. These figures are unrealistic, to say the least. (NTIA's worst case was only 1-10,000 devices per square kilometer. Much of its analysis assumed a value of 200 devices per square kilometer.)" XtremeSpectrum Ex Parte at Pgs. 5-6.

Fact 2: At Least Four Studies Used Only UWB Device .

The QUALCOMM, NTIA, Stanford and Sprint PCS/Time Domain studies each used only one UWB device in their testing and showed that harmful interference is caused by one UWB device at distances that far exceeds the normal office size.

XtremeSpectrum Myth 3: A PCS User Already Hears Noise From Other PCS Users.

XtremeSpectrum states: "The PCS studies assume that the UWB emitters and PCS handset exist alone, unaffected by any other sources of radio-frequency energy. This is never the case. Populated areas always have a background level of ambient radio noise. Some of the background noise into a PCS handset comes from other people's PCS calls. Signals from a competing provider's handset, with its main signal in some other PCS frequency block, are permitted to reach 50 millionths of a watt. Although a small number, this is still *10,000 times higher than the maximum proposed for UWB*. Other noise comes from same provider PCS base stations serving other cell sites nearby. The PCS studies fail to account even for this unavoidable self-generated interference." XtremeSpectrum Ex Parte at Pg. 6.

[8] Reply Comments of Intel Corporation filed October 27, 2001.

Fact 3: Noise From Other PCS Users Is Taken Into Account In Designing A PCS System.

The above statements demonstrate a lack of understanding of how CDMA works and how cellular or PCS systems work in general. The intrinsic noise due to other users in the system is an inherent feature of multiple access system and is budgeted for in the design of the system. Any excess noise from other sources, such as UWB devices, will eat into the system margin and render the system non-operative as designed. For this reason, Cingular filed example link budgets for TDMA and GSM systems.[9]

XtremeSpectrum Myth 4: UWB Won't Cause Interference Indoors Due to Propagation.

XtremeSpectrum asserts: "The PCS studies assume that interfering UWB signals propagate indoors as they would in outer space. In fact, however, the effects of interior walls, furniture, and within-the-room reflections all diminish the UWB signal strength. One widely accepted technical study shows that a typical indoor environment provides a 94% reduction (12 dB) relative to free space, over a 10 meter range. This greatly reduces the effect of UWB on PCS (and other systems)." XtremeSpectrum Ex Parte at Pg. 7.

Fact 4: Line-of-Sight Indoor Propagation Follows Free Space.

It is well-established that line-of-sight propagation indoor follows free space. When downloading files or exchanging business cards, the two clients are not usually separated by walls and neither is the victim receiver. They will all be in the same office or meeting room and subject to harmful interference.

The Intel Report[10] separates the distance between the UWB transmitter and the victim receiver into two regions, each of which has a different path loss exponent. For distances less than 10 meters, the free space path loss model is used. Most cubical, normal offices, some airport waiting areas, and meeting rooms are less than10 meters in size.

XtremeSpectrum Myth 5. UWB Devices Will Not Cause Any Aggregate Interference.

XtremeSpectrum asserts: "The PCS studies assume that signals from multiple UWB units aggregate to form stronger signals. This is incorrect.

UWB aggregation has taken on the status of an urban myth. Many filings in the docket state with great conviction that aggregation occurs, although none cites any evidence. UWB emissions add, as do other radio-frequency signals, but nonetheless they do not aggregate at a victim receiver. The reason is simple: UWB signals cannot travel

[9] See Cingular Ex Partes filed October 12, 2001 and May 10, 2001.
[10] See Reply Comments of Intel Corporation filed October 27, 2001.

far. As they propagate, the already small signals fall off much faster than they can add up. As a result, only the nearest UWB emitter can be significant. The signals from all others are so weak as to be negligible.

Suppose we could somehow arrange for 100,000 UWB emitters to be distributed through a building, each one of them 100 meters away from a PCS handset. The total signal received at the handset from all 100,000 units would be well under 1% of the signal from *one* UWB emitter, placed 3 meters away. Only the nearest emitter matters." XtremeSpectrum Ex Parte at Pgs. 7-8.

Fact 5: Interference Power Adds Non-Coherently.

Aggregate interference from UWB devices is by no means an "urban myth." To the contrary, another proponent of UWB, Intel, admitted that the aggregation of UWB devices could have the potential of causing additional interference. In Reply Comments, Intel wrote as follows:

> The aggregation of several UWB devices in the same area could have the potential of further increasing the noise floor of operating devices in the same frequency. If these devices are assumed to add non-coherently (assuming that different UWB transmissions operating in the same geographic area are not synchronized), then the aggregated average interference power will simply add. The additional interference will either reduce the acceptable operational distances of other wireless devices or impact the available link margin and potentially impact the perceived performance levels.

Intel Reply Comments at Pg. 20.

In other words, Intel has admitted that the aggregation of UWB devices will diminish the operation of other wireless devices. To be sure, Intel went on to try to explain away this thorny problem by speculating that the random location of UWB devices, the random data arrival rates, the possible mobility of the devices, and the possibility of ceasing transmissions when it is not necessary could lessen the aggregate interference. This sheer speculation is no substitute for empirical study. At this time, the record shows that the aggregation of UWB devices will exacerbate the harmful interference to existing services, including safety of life services, and no test in the record shows conclusively how this interference can be ameliorated. The Commission cannot just assume that the problem will not exist, as XtremeSpectrum suggests.

And, the problem of aggregation of UWB devices is most pronounced in office or home environments in which there could be as many as 4 UWB devices within 2 meters or less of the victim receiver. Someone using a PCS phone to call 911 to report an emergency, or a police officer, firefighter, or other first responder using a PCS phone to call for help, who is in the middle of an office cubical could be surrounded by at least 4

UWB devices within 2 meters. There is no basis for the Commission just to ignore the aggregate harmful interference from UWB devices.

III. Conclusion

In sum, the Wireless Companies urge the Commission to disregard the erroneous arguments put forth by XtremeSpectrum. In light of the tests in the record proving harmful interference to wireless phones from UWB emissions and consistent with the January 11th Stenbit Letter, the Wireless Companies urge the Commission not to authorize UWB communications devices below 6 GHz. We say above 6 GHz because of the harmful interference not only to PCS systems from UWB devices operating below 3.1 GHz, and DOD systems operating below 4.2 GHz (as reflected in Assistant Secretary of Defense Stenbit's letter), but also because UWB devices operating above 4.2 GHz and below 6 GHz would interfere with other critical aviation systems which are used to provide safety of life services. The January 11th Stenbit Letter expressly took account of this interference to such systems, referring to other executive branch organizations who also wish to protect their systems from interference.

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